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Discrimination of microearthquakes and quarry blasts based on the observations of the PSZI infrasound array and seismic station PSZ in Piszkés-tető, Hungary

Márta Kiszely, Bálint Süle, Csenge Czanik, Péter Mónus, and István Bondár
Geodetic and Geophysical Institute, RCAES, HAS, Budapest, Hungary (marta@seismology.hu)

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Márta Kiszely, Bálint Süle, Csenge Czanik, Péter Mónus, István Bondár
Geodetic and Geophysical Institute, Research Centre for Astronomy and Earth Sciences, Hungarian Academy of Sciences, Hungary (kiszely.marta@csfk.mta.hu)

Contamination of earthquake catalogues with anthropogenic events largely complicates seismotectonic interpretation. It is especially true for relatively low seismicity areas, such as Hungary. In the present study, we analyze the characteristics of earthquakes and blasts of quarries occurred between July 2017 and December 2018 in the North Hungarian Mountains in Hungary and in the southern part of Slovakia. An infrasound array (PSZI) was deployed in this region and officially began its operation in 1 June 2017. The central element of the array is co-located with the broadband seismological station, Piszkés-tető (PSZ). The seismic events were detected by the seismological station PSZ. Most of the quarry blasts were registered on the infrasound array PSZI.
The objective of this study was to find the optimal combination of various discrimination parameters to separate earthquakes from anthropogenic events. We examined the polarity of P wave arrivals and the amplitude ratios of different phases (Rg and high frequency P/S). We applied waveform cross-correlation to build correlation matrices at PSZ and performed hierarchical cluster analysis to identify event clusters. Because most of the quarry blasts were carried out by ripple-fire technology, we computed spectrograms and examined the spectral ratio between low and high frequencies and the steepness of spectra.
Overall, classes of earthquakes and quarry blasts have separated well from each other by combining the amplitude ratio, waveform similarity and the different spectral methods. If the infrasound signal that accompanies a quarry blast can be observed at the infrasound array, it provides further evidence that the event was indeed man-made.